MODBUS

Technical Reference Manual

LoRaWAN / Sigfox

Applicable for APP versions >= 2.0.0

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NEW DOCUMENTATION / NOUVELLE DOCUMENTATION

	ENGLISH	FRANCAIS
USER GUIDE	• **Dedicated to a product** • Cautions & electrical warnings • Declaration of conformity • Product functionalities and modes • Casing dimensions • Characteristics (casing and electrical) • LED explanations • Specific wiring on terminal blocks	• **Dédié à un produit** • Recommandations et avertissements électriques • Déclaration de conformité • Fonctionnalités et modes du produit • Dimensions du boitier • Caractéristiques (boitier et électrique) • Explication des LED • Câblage sur bornier spécifique au produit
TECHNICAL REFERENCE MANUAL	• **Dedicated to a product** • Registers content • Frame explanations (uplink and downlink)	• **Dédié à un produit** • Contenu des registres • Explication des trames (uplink et downlink)
INSTALLATION GUIDE	• **For all adeunis® products** • Configuration of the products • Installation and fixing • Start-up of the products • Opening and closing the case • Replace battery	• **Pour tous les produits adeunis®** • Configuration des produits • Installation et fixation • Démarrage des produits • Ouvrir et fermer les boîtiers • Remplacer la batterie

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1. REGISTERS

1.1 Generic registers

Register	Size (bytes)	Base	Description	Default Value	Range (Min-Max)	Comments
304	2	10	PIN code	0 (deactivated)	0 - 9999	PIN code used with ATPIN command. Value 0 disables the PIN code.
306	1	10	Product mode	0	0: PARK 1: PRODUCTION	In PARK mode, product is not using Radio. In PRODUCTION mode, product will send/receive RF uplinks/downlinks.
308	4	16	LED activity	0x0018007F	0 … 0xFFFFFFFF	Default: 18007F Eco : 180070 Other values : reserved

1.2 Applicative registers

Register	Size (bytes)	Base	Description	Default value	Min-Max Value	Comments
300	2	10	Keep alive period	8640 (24h)	2 ... 65535	X 10 seconds
301	2	10	Transmit period for periodic data 1	8640 (24h)	0 ... 65535	x 10 seconds 0: deactivated
320	2	10	Sampling period for alarms	180 (30 min)	1 ... 65535	X 10 seconds
321	1	16	Modbus link configuration	0x44 (19200/E/1 RS485)	0 … 0xFF	Bit 0: Bus type • 0: RS485 • 1: RS232 Bit 1: Stop bits • 0: 1 bit • 1: 2 bits Bits 2 and 3: Parity • 0: None • 1: Even • 2: Odd Bits 4 to 7: Baud rate • 0: 1200 • 1: 2400 • 2: 4800 • 3: 9600 • 4: 19200 • 5: 38400 • 6: 57600 • 7: 115200

322	2	10	Supply time of the external load (slave) before the Modbus request	0 (OFF)	0 … 65535	x 100ms • 0: no power supply (toward the slave) • From 1 to 65535: supply time of the external load (slave) before the Modbus request x100ms • 65535: permanent external power supply to the slave E.g.: if S322 is set to 250, the power supply will be delivered to the slave 250x100ms i.e. 25s before the transmission of the Modbus request to the slave
323	2	10	Transmit period for periodic data 2	8640 (24 h)	0 ... 65535	x 10 seconds 0: deactivated
324	2	10	Transmit period for periodic data 3	8640 (24 h)	0 ... 65535	x 10 seconds 0: deactivated
325	2	10	Transmit period for periodic data 4	8640 (24 h)	0 ... 65535	x 10 seconds 0: deactivated
326	2	10	Transmit period for periodic data 5	8640 (24 h)	0 ... 65535	x 10 seconds 0: deactivated
327	2	10	Transmit period for periodic data 6	8640 (24 h)	0 ... 65535	x 10 seconds 0: deactivated
329	2	10	Alarm repetition period	0	0 ... 65535	x sampling period (S320) 0: no repetition

1.3 Periodic data registers

Register	Size (bytes)	Base	Description	Default value	Min-Max value	Comments
330	4	16	Periodic data 1	0 (deactivated)	0 … 0xFFFFFFFF	Bits 3 to 0: number of registers Bit 4: Modbus registers type • 0: holding registers (read/write) • 1: input registers (read only) Bits 7 to 5: Associated periodic frame • 0: periodic frame 1 • 1: periodic frame 2 • 2: periodic frame 3 • 3: periodic frame 4 • 4: periodic frame 5 • 5: periodic frame 6 Bits 23 to 8: First register address Bits 31 to 24: Slave address: • 0: data deactivated • 1 à 247: slave address
331	4	16	Periodic data 2	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
332	4	16	Periodic data 3	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
333	4	16	Periodic data 4	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
334	4	16	Periodic data 5	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
335	4	16	Periodic data 6	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
336	4	16	Periodic data 7	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
337	4	16	Periodic data 8	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
338	4	16	Periodic data 9	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
339	4	16	Periodic data 10	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
340	4	16	Periodic data 11	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
341	4	16	Periodic data 12	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
342	4	16	Periodic data 13	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
343	4	16	Periodic data 14	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
344	4	16	Periodic data 15	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
345	4	16	Periodic data 16	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
346	4	16	Periodic data 17	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
347	4	16	Periodic data 18	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
348	4	16	Periodic data 19	0 (deactivated)	0 … 0xFFFFFFFF	See register 330
349	4	16	Periodic data 20	0 (deactivated)	0 … 0xFFFFFFFF	See register 330

1.4 Alarm registers

Register	Size (bytes)	Base	Description	Default value	Min-Max value	Comments
350	4	16	Alarm 1 configuration	0 (deactivated)	0 … 0xFFFFFFFF	Bits 1 to 0: Active thresholds • 1: Low threshold • 2: High threshold • 3: High and low thresholds Bit 2: Modbus register type • 0: holding registers (read/write) • 1: input registers (read only) Bit 3: Reserved Bits 4 and 6: Data type • 0: 16-bit unsigned integer • 1: 16-bit signed integer • 2: 32-bit unsigned integer • 3: 32-bit signed integer • 4: 32-bit unsigned integer (word swap) • 5: 32-bit signed integer (word swap) Bit 7: Reserved Bits 23 to 8: First register address Bits 31 to 24: Slave address: • 0: alarm deactivated • 1 à 247: slave address
351	2	16	Alarm 1 - high threshold	0	0 … 0xFFFFFFFF	
352	4	16	Alarm 1 - hysteresis of high threshold	0	0 … 0xFFFF	
353	2	16	Alarm 1 - low threshold	0	0 … 0xFFFFFFFF	
354	4	16	Alarm 1 - hysteresis of low threshold	0	0 … 0xFFFF	
355 - 359	-	-	Alarm 2 configuration	-	-	See registers 350 to 354
360 - 364	-	-	Alarm 3 configuration	-	-	See registers 350 to 354
365 - 369	-	-	Alarm 4 configuration	-	-	See registers 350 to 354
370 - 374	-	-	Alarm 5 configuration	-	-	See registers 350 to 354
375 - 379	-	-	Alarm 6 configuration	-	-	See registers 350 to 354
380 - 384	-	-	Alarm 7 configuration	-	-	See registers 350 to 354
385 - 389	-	-	Alarm 8 configuration	-	-	See registers 350 to 354
390 - 394	-	-	Alarm 9 configuration	-	-	See registers 350 to 354
395 - 399	-	-	Alarm 10 configuration	-	-	See registers 350 to 354

1.5 Radio registers

1.5.1 LoRaWAN Network Registers

Register	Description	Encoding	Details
201	Spreading Factor (SF) by default	Decimal	Default: 12 ***READ ONLY***
204	Reserved	Hexadecimal	Do not use
214	LORA APP-EUI (first part – MSB)	Hexadecimal	Default: 0 Key encoded on 16 characters. Each register contains a part of the key. Used during the JOIN phase in OTAA mode E.g.: APP-EUI = 0018B244 41524632 • S214 = 0018B244 • S215 = 41524632
215	LORA APP-EUI (second part – MSB)	Hexadecimal	
216	LORA APP-KEY (first part – MSB)	Hexadecimal	Default: 0 Key encoded on 32-byte characters. Each of the 4 registers contains 8 characters. Used during the JOIN phase in OTAA mode E.g.: APP-KEY = 0018B244 41524632 0018B200 00000912 • S216 = 0018B244 • S217= 41524632 • S218=0018B200 • S219= 00000912
217	LORA APP-KEY (second part – MID MSB)	Hexadecimal	
218	LORA APP-KEY (third part – MID LSB)	Hexadecimal	
219	LORA APP-KEY (fourth part – LSB)	Hexadecimal	
220	LoRaWAN Options	Hexadecimal	Default: 5 Bit 0: Activation of the ADR ON(1)/OFF(0) Bit 1: Reserved Bit 2: DUTYCYCLE ON(1)/DUTYCYCLE OFF(0) Bits 3 & 4: Reserved Bit 5 : CLASS C (1) / CLASS A (0) Bits 6 to 7: Reserved CAUTION: Deactivation of the Duty Cycle may result in a violation of the conditions of use of the frequency band, depending on the use of the device, thus violating the regulations in force. In the case of disabling the Duty Cycle, liability is transferred to the user. **Class C available only for EU868 LoRaWAN zone.**
221	Mode of activation	Decimal	Default: 1 Choice: (see NOTE 1 after the table) • 0: ABP • 1: OTAA
222	LORA NWK_SKEY (first part – MSB)	Hexadecimal	Default: 0 Parameter encoded on 16 bytes. Each of the 4 registers contains 4 bytes.
223	LORA NWK_SKEY (second part - MID MSB)	Hexadecimal	
224	LORA NWK_SKEY (third part - MID LSB)	Hexadecimal	
225	LORA NWK_SKEY (fourth part – LSB)	Hexadecimal	

226	LORA APP_SKEY (first part – MSB)	Hexadecimal	Default: 0 Parameter encoded on 16 bytes. Each of the 4 registers contains 4 bytes.
227	LORA APP_SKEY (second part - MID MSB)	Hexadecimal	
228	LORA APP_SKEY (third part - MID LSB)	Hexadecimal	
229	LORA APP_SKEY (fourth part – LSB)	Hexadecimal	
260	Reserved	Decimal	Do not use
261	Reserved	Decimal	Do not use
280	NETWORK ID	Hexadecimal	Default: 0 ***READ ONLY***
281	DEVICE ADDRESS	Hexadecimal	Default: 0

NOTE 1: The “Over The Air Activation” (OTAA) mode uses a JOIN phase before being able to transmit on the network. This mode uses the APP_ EUI (S214 and S215) and APP_KEY (S216 to S219) codes during this phase to create the keys for network communication. Once this phase is completed, the codes APP_sKEY, NWK_sKEY and DEVICE ADDRESS will be present in the corresponding registers. A new JOIN phase is started every time the device exits Command mode, a reset is performed, or the device is turned on.
Codes:
• APP_EUI identifier for global use (provided by default by adeunis®)
• APP_KEY device application key (provided by default by adeunis®)
The “Activation by personalization” (ABP) mode has no JOIN phase; it transmits directly on the network using the codes NWK_sKEY (S222 to S225), APP_sKEY (S226 to S229) and DEVICE ADDRESS (S281) to communicate.
Codes:
• NWK_sKEY network session key (provided by default by adeunis®)
• APP_KEY applicative session key (provided by default by adeunis®)
• DEVICE ADDRESS Address of the device in the network (provided by default by adeunis®)

Register	Size (bytes)	Base	Description	Default Value	Range (Min-Max)	Comments
303	1	10	LoRaWAN Confirmed mode	0	0-1	LoRaWAN only – activation or deactivation of the confirmed mode 0: deactivation 1: activation

1.5.2 Sigfox Network Registers

Register	Size (bytes)	Base	Description	Default Value	Range (Min-Max)	Comments
307	2	10	Sigfox Downlink period	1440 (24h)	0-65535	X 1 minute ⇨ Period: 1 min to 45 days
317	1	10	Sigfox Duty Cycle	1	0-1	0: duty cycle activated 1: duty cycle deactivated

2. RADIO PROTOCOL

Data with size greater than 1 byte will be transmitted MSB first.
In LoRaWAN, frames are sent on port 1.

1.6 Status byte

All frames sent by the product contain a status byte. Its format is identical for all IoT Adeunis products.

Alarm Status	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Frame Counter			AppFlag2	AppFlag1	HW	Low Bat	Config
No Error	0x00 to 0x07			0	0	0	0	0
Configuration done				0	0	0	0	1
Low bat				0	0	0	1	0
HW Error				0	0	1	0	0
AppFlag1				0	1	0	0	0
AppFlag2				1	0	0	0	0

The status byte provides two bits reserved for a specific use of each product (AppFlag1 and AppFlag2).
For this product:

- AppFlag1: configuration inconsistency
  - Samples lost in periodic data frame because the payload is not enough.
- AppFlag2: indicate a Modbus read error. For example, a slave that does not respond to the master request.
  - 0: no error detected
  - 1: at least one error has been detected

1.7 Uplink Frame format

1.7.1 Product configuration (0x10)

This frame is sent following the reception of a frame with code 0x01, or at the start of the product.

Offset (in byte)	Data	Description
0	0x10	Frame code
1	Status	Status byte
2-3	S300	Transmission period of the Keep Alive frame
4-5	S301	Transmission period of the periodic frame 1
6-7	S320	Sampling period
8	S321	Modbus configuration
9-10	S322	Configuration of supply time of the external load (slave) before the Modbus request

Decoding example:

Offset (in byte)	Data	Description
0	0x10	Frame code
1	0x10	Frame counter: 0 Bit4@1: modbus error detected Bit1@0: configuration consistent
2-3	0x21C0	8640 => 8640 x 10s = 86400s = 24h
4-5	0x21C0	8640 => 8640 x 10s = 86400s = 24h
6-7	0x00B4	180 x 10s => 1800s = 30min
8	0x44	19200/E/1/RS485
9-10	0x100	256 * 100 ms => 25.6sec

1.7.2 Network configuration (0x20)

This frame is sent following the reception of a frame with code 0x02, or at the start of the product.

1.7.2.1 LoRaWAN

Offset (in byte)	Data	Description
0	0x20	Frame code
1	Status	Status byte
2	S220	LoRaWAN options Bit 0: Activation of the ADR ON(1)/OFF(0) Bit 1: Reserved Bit 2: DUTYCYCLE ON(1)/DUTYCYCLE OFF(0) Bits 3 & 4: Reserved Bit 5: CLASS A (0) / CLASS C (1) *(EU868 only)* Bits 6 to 7: Reserved
3	S221	Provisioning mode (0: ABP, 1: OTAA)

Decoding example:

Offset (in byte)	Data	Description
0	0x20	Frame code
1	0x20	Frame counter: 1 Bit1@0: no Low Bat
2	0x25	CLASS C Duty cycle activated ADR ON
3	0x01	OTAA

1.7.2.1 Sigfox

Offset (in byte)	Data	Description
0	0x20	Frame code
1	Status	Status byte
2	S202	Retry count

Decoding example:

Offset (in byte)	Data	Description
0	0x20	Frame code
1	0x20	Frame counter: 1 Bit1@0: no Low Bat
2	0x02	2 retries

1.7.3 Keep alive frame (0x30)

This frame is sent after an amount of time determined by S300 register

Offset (in byte)	Data	Description
0	0x30	Frame code
1	Status	Status byte

Decoding example:

Offset (in byte)	Data	Description
0	0x30	Frame code
1	0x22	Frame counter: 1 Bit1@1: Low Bat detected

1.7.4 Periodic data 1 (0x44)

This frame is sent according to the period chosen by the user (register S301) and contains the configured Modbus periodic data. The organization of the bytes in this frame therefore depends on the configuration set by the user.

Maximum number of samples per frame:

- LoRaWAN EU868: 24 registers
- Sigfox: 5 registers
- LoRaWAN US915 and AS923: 4 registers

Offset (in byte)	Data	Description
0	0x44	Frame code
1	Status	Status
2-3	Modbus register 1	Sigfox / LoRa EU868 / LoRa US915 / LoRa AS923
4-5	Modbus register 2	
6-7	Modbus register 3	
8-9	Modbus register 4	
10-11	Modbus register 5	Sigfox / LoRa EU868
12-13	Modbus register 6	LoRa EU868
14-15	Modbus register 7	
16-17	Modbus register 8	
18-19	Modbus register 9	
20-21	Modbus register 10	
22-23	Modbus register 11	
24-25	Modbus register 12	
26-27	Modbus register 13	
28-29	Modbus register 14	
30-31	Modbus register 15	
32-33	Modbus register 16	
34-35	Modbus register 17	
36-37	Modbus register 18	
38-39	Modbus register 19	
40-41	Modbus register 20	
42-43	Modbus register 21	
44-45	Modbus register 22	
46-47	Modbus register 23	
48-49	Modbus register 24	

Decoding example (for 2 samples):

Offset (in byte)	Data	Description
0	0x44	Frame code
1	0x00	Frame counter: 4 Bit1@0: Low Bat not detected
2-3	0x01B3	VALUE of the first register in the order of the configuration defined for this frame in registers 330 à 349
4-5	0x1000	VALUE of the second register in the order of the configuration defined for this frame in registers 330 à 349

1.7.5 Periodic data 2 (0x5F)

This frame is sent according to the period chosen by the user (register S323) and contains the configured Modbus periodic data. The organization of the bytes in this frame therefore depends on the configuration set by the user.

See “Periodic data 1 (0x44)” for more details

1.7.6 Periodic data 3 (0x60)

This frame is sent according to the period chosen by the user (register S324) and contains the configured Modbus periodic data. The organization of the bytes in this frame therefore depends on the configuration set by the user.

See “Periodic data 1 (0x44)” for more details

1.7.7 Periodic data 4 (0x61)

This frame is sent according to the period chosen by the user (register S325) and contains the configured Modbus periodic data. The organization of the bytes in this frame therefore depends on the configuration set by the user.

See “Periodic data 1 (0x44)” for more details

1.7.8 Periodic data 5 (0x62)

This frame is sent according to the period chosen by the user (register S326) and contains the configured Modbus periodic data. The organization of the bytes in this frame therefore depends on the configuration set by the user.

See “Periodic data 1 (0x44)” for more details

1.7.9 Periodic data 6 (0x63)

This frame is sent according to the period chosen by the user (register S327) and contains the configured Modbus periodic data. The organization of the bytes in this frame therefore depends on the configuration set by the user.

See “Periodic data 1 (0x44)” for more details

1.7.10 Alarms (0x45)

This frame is sent during the appearance, or disappearance, of a threshold exceeding alarm.

Offset (in byte)	Data	Description
0	0x45	Frame code
1	Status	Status byte
2	Alarm status	0: No alarm 1: High threshold 2: Low threshold
3	Slave address	Concerned slave address
4-5	Register address	Register address in the slave
6-7	Modbus register 1 value	
8-9	(Modbus register 2 value)	Only if register length is '32 bits'

Decoding example:

Offset	Data	Description
0	0x45	Frame code
1	0x00	Frame counter: 4 Bit1@0: Low Bat not detected
2	0x01	1: register value is higher than the configured threshold
3	0xA0	Alarm concerns slave address: 160
4-5	0x0032	Alarm concerns register address: 50
6-7	0x1234	Register value: 4660 (16 bits)

1.7.11 Read MODBUS registers response (0x5E)

This frame is sent in response to a downlink "Read MODBUS registers request" (0x05).
If the request is erroneous, or there was a read error, this frame does not contain registers.

Maximum number of samples per frame:

- LoRaWAN EU868: 24 registers
- Sigfox: 5 registers
- LoRaWAN US915 and AS923: 4 registers

Offset (in byte)	Data	Description
0	0x5E	Frame code
1	Status	Status
2-3	Modbus register 1	Sigfox / LoRa EU868 / LoRa US915 / LoRa AS923
4-5	Modbus register 2	
6-7	Modbus register 3	
8-9	Modbus register 4	
10-11	Modbus register 5	Sigfox / LoRa EU868
12-13	Modbus register 6	LoRa EU868
14-15	Modbus register 7	
16-17	Modbus register 8	
18-19	Modbus register 9	
20-21	Modbus register 10	
22-23	Modbus register 11	
24-25	Modbus register 12	

26-27	Modbus register 13	
28-29	Modbus register 14	
30-31	Modbus register 15	
32-33	Modbus register 16	
34-35	Modbus register 17	
36-37	Modbus register 18	
38-39	Modbus register 19	
40-41	Modbus register 20	
42-43	Modbus register 21	
44-45	Modbus register 22	
46-47	Modbus register 23	
48-49	Modbus register 24	

Decoding example (for 2 samples):

Offset (in byte)	Data	Description
0	0x5E	Frame code
1	0x00	Frame counter: 0 Bit1@0: Low Bat not detected
2-3	0x01B3	435: Value of the first register
4-5	0x1000	4096: Value of the second register

1.7.12 Write MODBUS registers ACK (0x2F)

This uplink is sent when a downlink “Write MODBUS registers “(0x08) is received.

Offset (in byte)	Data	Description
0	0x2F	Frame code
1	Status	Status byte
2	Downlink Frame code	Indicate which downlink has generated this uplink (0x08)
3	Request status	- 0x01: success - 0x02: error - generic - 0x04: error – invalid request

Decoding example:

Offset (in byte)	Data	Description
0	0x2F	Frame code
1	0x20	Frame counter: 1 Bit1@0: no Low Bat
2	0x06	This ACK concerns last received 0x08 request
3	0x01	success

1.7.13 Response to Get register request (0x31)

Following reception of a downlink frame with the code 0x40, the frame 0x31 is transmitted. It contains all the values of the registers requested in the downlink frame 0x40.

Offset (in byte)	Data	Description
0	0x31	Frame code
1	Status	Status byte
2-3	Value 1	If value 1 is a 2-byte register
4	Value 2	If value 2 is a 1-byte register
5-8	Value 3	If value 3 is a 4-byte register
…		

If an error is detected in the request, the returned 0x31 frame will be empty.

Note: the size of the data registers is variable depending on the register number. Refer to the list of registers to determine the size of each one and to deduce the total size of the data returned by the 0x31 frame.

Decoding example:

Offset (in byte)	Data	Description
0	0x31	Frame code
1	0x80	Frame counter: 4 Bit1@0: Low Bat not detected
2-3	0x1234	4660 (considering that value 1 is a 2-byte register)
4	0xFF	255 (considering that value 2 is a 1-byte register)
5-8	0x00000000	0 (considering that value 3 is a 4-byte register)
…		

1.7.14 Response to Set register request (0x33)

Following reception of a downlink frame with the code 0x41, the frame 0x33 is transmitted. It shows whether the downlink frame (0x41) has been received and gives information on the support status of the latter.

Offset (in byte)	Data	Description
0	0x33	Frame code
1	Status	
2	Request status	- 0x00: N/A - 0x01: success - 0x02: success – no update (value to set is the current register value) - 0x03: error – coherency - 0x04: error – invalid register - 0x05: error – invalid value - 0x06: error – truncated value - 0x07: error – access not allowed - 0x08: error – other reason
3-4	Register Id	Indicates to the user the register that caused the error (only if “Request Status” is different from 0x01).

CAUTION: if the request 0x41 concerns several registers, the device will stop the analysis of the Downlink request at the first error and will send the Status frame with the reason and the identifier of the register concerned.

In the event of an error, if a partial reconfiguration has taken place before the error was detected, the device restarts and returns to its last valid configuration. As a result, you will have to configure the device again with the new data.

Decoding example:

Offset (in byte)	Data	Description
0	0x33	Frame code
1	0x80	Frame counter: 4 Bit1@0: Low Bat not detected
2	0x04	invalid register
3-4	0x0140	320: register S320 does not exist (should be S3XX)

1.7.15 Transmit conditions

Frame code	Description	Sending conditions
0x10	Status (configuration)	• Product start up • Exit configuration mode (AT command) • Reception of frame 0x01 (get product config)
0x20	Network configuration	• Product start up • Exit configuration mode (AT command) • Reception of frame 0x02 (get network config)
0x2F	Write MODBUS registers ACK	• Reception of frame 0x08 (write MODBUS registers)
0x30	Keep alive	• Periodically if no periodical data is defined
0x44 **0x5F** **0x60** **0x61** **0x62** **0x63**	Periodic data	• Periodically
0x45	Alarm	• Threshold crossing
0x5E	Read MODBUS registers response	• Reception of frame 0x05 (read MODBUS registers)

1.8 Downlink Frame format

1.8.1 Get applicative configuration (0x01)

Offset (in byte)	Data	Description
0	0x01	Frame code

When the device receives the downlink, it will generate a product configuration frame (0x10).

1.8.2 Get network configuration (0x02)

Offset (in byte)	Data	Description
0	0x02	Frame code

When the device receives the downlink, it will generate a network configuration frame (0x20).

1.8.3 Read MODBUS registers request (0x05)

Offset (in byte)	Data	Description
0	0x05	Frame code
1	Slave address	
2	Register type	0: holding 1: input
3-4	1st register address	Address of the first register to read
5	Number of registers	Number of registers to read

When the device receives the downlink, it will generate a Data on Demand frame (0x5E).

Coding example:

Offset (in byte)	Data	Description
0	0x05	Frame code
1	0x0A	Slave address: 10
2	0x01	Input register type
3-4	0x0020	First register address: 32
5	0x02	2 16-bits registers to read => 32bits

1.8.4 Write MODBUS registers request (0x08)

This frame allows you to ask the product to write or register a Modbus slave.
A transaction (0x2F) is returned by the product.
The frame contains at most:
• 24 registers in LoRaWAN US915,
• 3 registers in LoRaWAN AS923,
• 1 register in Sigfox,
• 23 registers in LoRaWAN EU868

Offset (in byte)	Data	Description
0	0x08	Frame code
1	Slave address	
2-3	1st register address	Address of the first register to read
4	Number of registers	Number of registers to write
5-6	Register value 1	
7-8	Register value 2	
9-10	Register value 3	
…		

Coding example:

Offset (in byte)	Data	Description
0	0x08	Frame code
1	0x0A	Slave address: 10
2-3	0x0020	First register address: 32
4	0x03	3 registers
5-6	0x1234	Register 32 value
7-8	0x5678	Register 33 value
9-10	0x9ABC	Register 34 value

1.8.5 Get registers (0x40)

This frame (0x40) allows you to inform the device through the network that it must send the values of specific S3XX registers in an uplink frame (0x31).

Offset (in byte)	Data	Description
0	0x40	Frame code
1	CONFID1	Index of the register to be sent. The corresponding register is 300 + CONFIDX value.
2	CONFID2	
3	CONFID3	

IMPORTANT: the user can specify several CONF IDs in the downlink frame but it is up to the user's responsibility to verify that according to the protocol, the size of the data available in a downlink will be large enough to contain all the desired data. Otherwise, the application will send only the first values.

In Sigfox mode: backend may request to send 8 bytes in a downlink. All unused bytes should set to 0xFF to ask the product to stop the downlink frame parsing.

Coding example:

Offset (in byte)	Data	Description
0	0x40	Frame code

1	0x00	Get register S300
2	0x14	Get register S320
3	0x20	Get register S332
4-7	0xFFFFFFFF	In SFX: ignored by product

1.8.6 Set registers (0x41)

This frame (0x41) allows you to change the value of requested S3XX registers.

Offset (in byte)	Data	Description
0	0x41	Frame code
1	CONFID1	Index of the register to be changed. The corresponding register is “300 + CONFID1“
2	Value of CONF ID 1	Value to set In this example, its value is contained in 1 byte
3	CONFID2	Index of the register to be changed. The corresponding register is “300 + CONFID2”
4-5	Value of CONF ID 2	Value to set In this example, its value is contained in 2 bytes
…		

Following the sending of the downlink 0x41, the associated uplink 0x33 is immediately returned. If the update of the register(s) went well, the device will perform a backup and begin its restart procedure automatically. In addition, the Config bit of the status byte will be set to 1 in the next scheduled uplink frame (periodic or alarm or keep alive frame) if everything went well.

Coding example:

Offset (in byte)	Data	Description
0	0x41	Frame code
1	0x14	Register to modify is S320
2-3	0x00AA	Value to set in S320 is 170 (S320 is a 2-byte register)
4	0x1D	Register to modify is S329
5	0x02	Value to set in S330 is 2 (S329 is a 1-byte register)
…		